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SCIENTIFIC LITERATURE.

Charles Lyell and Modern Geology. By PROF. T. G. BONNEY, F.R.S. *The Century Science Series.* Macmillan & Co., New York. 1895. Pp. 221, with index. \$1.25.

The life of Charles Lyell, its fruition in the twelve editions of the *Principles of Geology*, and Lyell's influence on modern geology, form a subject worthy of the admirable treatment given it by Prof. Bonney. Brief as it is, this biography adequately spans his seventy-eight years, showing how he trained himself broadly in liberal knowledge and in science; how he developed a single purpose—"to put geology on a more sound and philosophical basis"—and how he pursued it so earnestly that Darwin could say: "The science of geology is enormously indebted to Lyell—more so, as I believe, than to any other man who ever lived."

Charles Lyell, born in 1797, the oldest son of Charles Lyell, sprang from a cultured family. His father was a student of literature and a lover of natural history, with a particular interest in entomology and botany. Thus the son inherited tastes which, developed by early associations as well as by Oxford training, fitted him for his life task as author and scientist. In spite of near sightedness, he was an accurate observer; he thought clearly; and his thought was no less clearly stated. The power of analysis and the power of expression, highly developed in combination, ever place their possessor among the leaders of men.

Lyell's studies in geology began in 1817 with lectures by Prof. Buckland, who was only thirteen years his senior and had been but recently appointed reader in geology at Oxford. Buckland roused enthusiasm for the science, but did not establish in his student's mind the verity of the diluvial theory. Ten years of study, rest for his eyes's sake, and travel on the Continent as well as in England, led Lyell from the profession of law, which he had entered upon, to the pursuit of geology. In 1828 he spent four months with Murchison in the volcanic district of central France, which Scrope had just made known to scientists. "The great flows of basalt—some fresh and intact, some

only giant fragments of yet vaster masses—the broken cones of scoria, and the rounded hills of trachyte in Auvergne, supplied him with links between existing volcanoes and the huge masses of trap with which Scotland had made him familiar; while these basalt flows—modern in a geological sense, but carved and furrowed by the streams which still were flowing in their gorges—showed that rain and rivers were most potent, if not exclusive, agents in the excavation of valleys."

"The whole tour," wrote Lyell to his father, "has been rich, as I had anticipated (and in a manner which Murchison had not), in those analogies between existing nature and the effects of causes in remote eras which it will be the great object of my work to point out. I scarcely despair now, so much do these evidences of modern action increase upon us as we go south (towards the more recent volcanic seat of action), of *proving* the positive identity of the causes now operating with those of former times."

In 1829 the discussions were hot in the Geological Society between those who maintained the hypothesis of a universal deluge, and those who interpreted Nature through uniformity of modern and ancient causes. In April Lyell wrote to Dr. Mantell:

"A splendid meeting (at the Geological Society) last night, Sedgwick in the chair. Conybeare's paper on Valley of the Thames, directed against Messrs. Lyell and Murchison's former paper, was read in part. Buckland present to defend the 'Diluvialists.' * * * Greenough assisted us by making an ultra speech on the importance of modern causes. * * * Murchison and I fought stoutly, and Buckland was very piano. Conybeare's memoir is not strong by any means. He admits three deluges before the Noachian; and Buckland adds God knows how many *catastrophes* besides; so we have driven them out of the Mosaic record fairly."

How faintly, like blows of battle-axe on medieval armor, rings the echo of that controversy in this day! Yet it was the first and not the least of Lyell's services that he led the attack which drove that hypothesis of the theologians from its intrenched position.

Tried in debate and developed thereby, Lyell's ideas begot a purpose which absorbed his means, his time and his thought. That purpose is stated in the title of his book: 'Principles of Geology; being an Attempt to Explain the Former Changes of the Earth's Surface by Reference to Causes now in Operation.' To this end he devoted the energies of a life singularly free from limitations and cares, such as ordinarily divert men from a single object.

The first volume of the Principles was written in the autumn of 1829, and published in the winter; the second appeared early in 1832, and the third in May, 1833. Five editions of the work had been issued by the spring of 1837. In 1838 the third volume was published separately as the 'Elements of Geology,' and the Principles, thus curtailed, passed through editions from the sixth to the eleventh during the author's lifetime, the twelfth being under way at the time of his death, in 1875.

Thus for forty-five years he pursued his purpose. There is danger in lifelong devotion to one hypothesis, but Lyell was armed against narrowing bias by his methods of observation and by the breadth of his mind. The hypothesis, which a small man would have spun to a vanishing thread, in Lyell's hands was forged into a chain of causality, binding past and present.

In accordance with one favorite saying of his: 'Go and see,' he travelled throughout western Europe and eastern America, searching always with painstaking care for facts. And obeying another principle, 'Prefer reason to authority,' (even when that authority was his own published conclusion), he kept his work abreast of the advance of geology, for which he had indicated the way.

Uniformitarianism did not originate with Lyell, but he became the great exponent of that principle. Not priority, but thoroughness, makes for reputation. Weighing the broader results of Lyell's studies, Prof. Bonney concludes: "We may be sure, that if Lyell were now living he would frankly recognize new facts, as soon as they were established, and would not shrink from any modification of his theory which these might demand. Great as were his services

to geology, this, perhaps, is even greater—for the lesson applies to all sciences and to all seekers after knowledge—that his career, from first to last, was the manifestation of a judicial mind, of a noble spirit, raised far above all party passions and petty considerations, of an intellect great in itself, but greater still in its grand humility; that he was a man to whom truth was as the 'pearl of price,' worthy of the devotion and, if need be, the sacrifice of a life."

BAILEY WILLIS.

Die Gastropoden der Plankton-Expedition, von DR. H. SIMROTH. Kiel & Leipzig, Lipsius & Fischer. 1895. 4to., 206 pp., 22 pl.

The Plankton-Expedition, as many of our readers are aware, had for its object the study of pelagic life in the North Atlantic, and especially its distribution in depth; the drawing, as it were, of the bathymetric contours of oceanic life. The material thus gathered has been distributed among many naturalists for study, and a large number of essays have already been printed under the supervision of the general editor, Prof. Victor Hansen, of Kiel.

The latest contribution is by Prof. Heinrich Simroth, of Leipzig, already well known by numerous valuable studies of the mollusks, and especially by his editorship of the new edition of that part of Bronn's 'Thier-reichs' relating to the Mollusca. It comprises observations on larval and pelagic Gastropods, fully illustrated and of great interest.

After the reaction against the methods of descriptive biology based on superficial characters, which began about twenty-five or thirty years ago, so rich were the results derived from embryological and anatomical researches that the more hasty of the younger workers concluded in their enthusiasm that surface characters were of no value whatever; and this view was carried so far that we find one naturalist gravely arguing that the only proper basis for a classification of the Gastropods would be found in the number and arrangement of the ganglionic cells, which he had studied in half a dozen species of land snails. Even the better informed and more cautious biologists were led to doubt if the characters of the shell in mollusks would lend any aid to the study of the